(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 509 602 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **92201055.8**

(51) Int. Cl.5: **B67D 1/00**, B67D 1/12

(22) Date of filing: **14.04.92**

(30) Priority: **16.04.91 IT MI911040**

(43) Date of publication of application:
21.10.92 Bulletin 92/43

(84) Designated Contracting States:
DE ES FR GB

(71) Applicant: **UGOLINI S.P.A.**
Via Orobia 11
I-20139 Milan(IT)

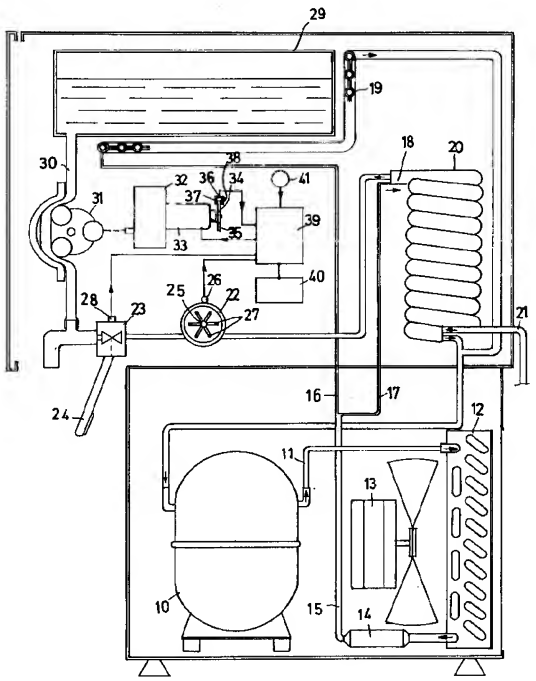
(72) Inventor: **Ugolini, Giancarlo**
Via Orobia, 11
I-20139 Milan(IT)

(74) Representative: **Henke, Erwin et al**
Ing.Barzanò & Zanardo Milano S.p.A. Via Borgonuovo, 10
I-20121 Milano(IT)

(54) Drink dispensing machine.

(57) A drink dispensing machine comprising a device for controlling the drink concentration, where the drinks consist of a liquid concentrate plus water which originate respectively from a suitable container (29) and a mains system (21) of variable flow characteristics. The machine comprises a sensor (26) for determining the water flow rate variation in order to vary the speed of a liquid concentrate feed pump (31), hence enabling the liquid-water concentration ratio to be maintained constant.

Fig.1



EP 0 509 602 A1

This invention relates to a drink dispensing machine.

Machines for dispensing drinks are known, the drink being prepared during withdrawal by mixing, within the delivery tap, mains water with syrup from a container in a predetermined mixing ratio to give the dispensed drink the required sugar concentration, which has to he maintained with time independently of the quantity withdrawn to ensure, within narrow tolerances, that the drink possesses the chemical and organoleptic characteristics established by the producer and by law.

In this respect, a given syrup of determined characteristics has to be diluted with a predetermined quantity of water to obtain a final product having the optimum organoleptic characteristics established by the producer and the chemical characteristics prescribed by law.

In these machines it is therefore sought to maintain a constant flow rate for the component liquids of the drink, this being achieved in the following manner:

- in the case of the syrup, by a positive displacement pump which if rotated at constant speed provides a constant flow rate;
- in the case of the water, by hydrodynamic devices (such as constrictions, compensators, pressure reducers and controllers) which attempt to limit the negative effects of the inevitable variations in mains pressure from one locality or place to another and from one moment to another, which result in variations in water throughput.

There is also a requirement for varying the dilution ratio, for example when the syrup is changed.

This requirement is satisfied either by changing the rotation speed of the syrup pump and hence its nominal throughput, or by changing the setting or adjustment of the hydrodynamic compensator devices and hence the water throughput.

Some manufacturers use the first method, by varying the syrup pump r.p.m. and considering the water throughput constant. Other manufacturers use the second method, by seeking to maintain the syrup pump r.p.m. constant and adjusting the water control devices to obtain the required flow rate.

The most apparent defect and limitation of the stated known art is the assumption that the mains water flow rate is constant, this however being a quantity which by its nature is unpredictably variable and only approximately controllable.

All this is reflected by the difficulty of maintaining the organoleptic and chemical parameters constant at values established by the producer and by current law.

The object of the present invention is to solve the problems of the known art by providing a machine in which the usual mains water flow variations in no way influence the final water-syrup mixing ratio.

This object is attained by a drink dispensing machine in which the drink consists of a mixture of syrup and water formed during its withdrawal within a tap of said machine, said syrup originating from a vessel/container by the action of a pump, and said water being fed from a mains system of substantially variable flow characteristics via a delivery valve, characterised in that said machine comprises sensor means for measuring the flow rate of the water fed from said mains system and means for setting a syrup-water dilution ratio, said means being connected to an electronic device for controlling the speed of said syrup feed pump such as to reduce or increase the pump speed in accordance with the water flow rate reductions or increases measured by said sensor means, to maintain said drink dilution ratio constant.

According to one embodiment of the present invention, said electronic control device is further connected to a device for measuring the rotation speed of said syrup feed pump, said electronic control device being arranged to use measurements made by said rotation speed measuring device to effect feedback regulation of the rotation speed of said syrup feed pump.

According to a preferred embodiment of the present invention, said sensor means for measuring the flow rate of the water fed by said mains system consist of a flow meter comprising a impeller, permanent magnets arranged at the ends of each blade of said impeller and a first magnetic Hall effect sensor.

Preferably, said device for measuring the rotation speed of said syrup feed pump consists of a perforated disc fixed onto the shaft of said pump and associated with a photocoupler.

Preferably, said pump which feeds the syrup from said vessel/container is a peristaltic pump which acts on a flexible discharge tube connected at one end to said vessel/container and at the other end to said tap.

The structural and operational characteristics of a machine according to the present invention will be more apparent from the description given by way of non-limiting example with reference to the accompanying schematic drawings, in which:

Figure 1 is a schematic mechanical diagram of a preferred embodiment of a machine according to the invention;

Figure 2 is an operational block diagram of a control device for the machine according to the invention.

In Figure 1, the reference numeral 10 indicates a compressor for compressing the refrigerant fluid of the refrigeration cycle.

The compressor 10 is connected by a pipe 11 to the inlet of a condenser 12 cooled by a fan 13.

The outlet of the condenser 12 is connected via a filter 14 and a pipe 15 to two capillary tubes 16 and 17 leading to the inlets of two evaporators indicated by 18 and 19 respectively.

The evaporator 18 is located within a heat exchanger 20 of the fluid-fluid type without counter-current contact.

In this manner, within the heat exchanger 20 the refrigerant fluid cools within the heat exchanger 20 the water originating from a pipe 21 which is connected to the water mains system, not shown.

Along the pipe 21 there are a flow meter 22 and a water delivery valve 23 operated by an opening-closure lever 24.

In this manner, when the water delivery valve 23 is opened, water flows into the pipe 21 and the flow meter 22 measures its instantaneous flow rate, before it reaches the tap 53 where it mixes with the syrup from the flexible tube 30.

In a preferred embodiment of this invention, the flow meter 22 comprises an impeller 25, a magnetic sensor 26 and a plurality of permanent magnets 27.

Each permanent magnet of the plurality 27 can be fixed to the end of each blade of the impeller 25, as shown in the preferred embodiment of the present invention. However, both the impeller and the permanent magnets can be provided in other arrangements.

Said impeller 25 rotates at an angular speed directly proportional to the rate of water flow through the pipe 21, with the result that the magnetic sensor 26 is exposed to the magnetic fields generated by the magnets 27 in turn, at a frequency directly proportional to the water flow rate.

The magnetic sensor 26 consists preferably of a Hall effect sensor, formed essentially from a plate of conducting material traversed by an electric current, a potential difference being induced in the plate whenever it is immersed in a magnetic field.

It can be appreciated that in this manner the plurality of magnets 27 act on the sensor 26 without any mechanical contact, so minimizing the possibility of wear and faults.

A sensor 28 is provided at the water delivery valve 23 to sense whether the water delivery valve 23 is open or closed.

Preferably, the sensor 28 is also a magnetic Hall effect sensor.

Again with reference to Figure 1, it can be seen that the evaporator 19 is located in heat transfer contact with a vessel/container 29 to contain the syrup to be mixed with the water.

It is apparent that with such a configuration both the water and the syrup are cooled by a single refrigeration circuit.

To the outlet of the vessel/container 29 there is connected a pipe 30 along which there is a positive displacement pump 31.

In a preferred embodiment the positive displacement pump 31 can be a peristaltic pump, in which case the pipe 30 or the discharge of syrup from the vessel/container 29 must be a flexible tube.

The positive displacement pump 31 is preferably driven by an electric motor 33 via a reduction gear 32.

The electric motor 33 is provided with a measuring device 34 for measuring its instantaneous rotation speed.

In a preferred embodiment the instantaneous speed measuring device 34 can be formed from a perforated disc 35 rigid with the shaft of the electric motor 33, and a photocoupler 36.

The photocoupler 36 consists of a light source 37 mounted in front of a photosensor 38.

The perforated disc 25 and the photocoupler 36 are mounted in such a manner that the light beam generated by the light source 37 can reach the photosensor 38 only via the holes in the disc 35.

In this manner the photosensor 38 is struck by light generated by the light source 37 at a frequency directly proportional to the rotation speed of the electric motor 33.

It is apparent that there is no mechanical contact between the perforated disc 35 and the photocoupler 36, the possibility of wear and faults thus being minimized because of the total absence of friction.

In a further embodiment, the measuring device 34 can be a dynamo tachometer or a Hall sensor, by fixing a permanent magnet rigidly to a disc which rotates with the motor.

Downstream of the positive displacement pump 31 the tube 30 is connected to the pipe 21 so that the syrup mixes with the water.

The sensor 26 installed on the flow meter 22, the sensor 28 on the water delivery valve 23 and the measuring device 34 on the motor 33 are electrically connected to an electronic control device 39.

The electronic device 39 is powered by a stabilized power unit 40, and is connected to a potentiometer 41.

When the user operates the lever 24 to open the water delivery valve 23, the sensor 28 feeds a signal to the electronic device 39.

Simultaneously with the opening of the water delivery valve 23 the water begins to flow through the pipe 21, this being immediately sensed by the flow meter 22, which also begins to feed signals to the electronic device 39.

On the basis of the signals received from the

sensors 28 and 26, the electronic device 39 operates the electric motor 33 with the result that the syrup begins to flow through the tube 30.

The electronic device 39 is arranged to regulate the angular rotation of the electric motor 33 on the basis of the signals emitted by the instantaneous speed measuring device 34 and the signals emitted by the flow meter 22.

If the rate of water flow through the pipe 21 is not equal to the set value or undergoes sudden variation, the electronic control device 39 acts on the positive displacement pump 31 to increase or decrease the syrup flow through the tube 30, in order to maintain the set water-syrup mixing ratio.

The operator can however intervene directly to modify the dilution ratio of the water-syrup mixture by operating the potentiometer 41.

On closing the water delivery valve 23, the sensor 28 feeds to the motor 33 by means of the electronic device 39 a stop signal to prevent the inertia of the flow meter 22 inducing a residual or uncontrolled flow of syrup alone.

It is apparent that in this manner the control system consisting of the electronic device 39, the sensors 26, 28 and 34, and the actuator 33 operates completely automatically to maintain the mixture dilution constant at every moment during the entire delivery from the opening to the closure of the water delivery valve 23.

The operation of the control system of a machine according to the present invention is described hereinafter in greater detail with reference to the accompanying Figure 2, which represents an operational block scheme showing the connections between the main components of a control system 42 for controlling the water-syrup mixing ratio.

The values of all the quantities, hereinafter indicated with reference to the block diagram of Figure 2, are to be considered standardized.

The reference numeral 43 indicates the input to the control system 42, and 44 indicates the output of said control system 42.

The input 43 is represented by the instantaneous water flow rate, while the output 44 is represented by the water-syrup mixture.

The water flow rate 43 in the process under examination is an exogenous variable, on which the control system cannot act directly.

The mixing ratio of the mixture 44 represents the controlled variable, which must be maintained constant at every moment independently of the water flow rate.

The flow rate of the mixture 44 is given by the sum of the water flow rate 43 and the syrup flow rate 45.

The syrup flow rate 45 represents the control variable on which the feedback regulating system, indicated overall by 46, acts to maintain the controlled variable 44 constant independently of the value of the exogenous variable 43.

The input to the feedback regulating system 46 is represented by the measurement 47 of the exogenous variable 43, said measurement 47 being made by a first transducer 48.

The transducer 48 of the operational scheme of Figure 2 corresponds to the flow meter 22 in the mechanical schematic diagram of Figure 1.

The control system 42 begins to operate only after receiving a signal from the sensor 28 indicating that the water delivery valve 23 has been opened.

The feedback regulating system 46 comprises a regulator 49, operationally represented by the electronic control device 39, in series with which there is an actuator 50.

The actuator 50 is operationally represented by the electric motor 33 and the positive displacement pump 31.

The output of the actuator 50, represented by the syrup flow rate 45, is measured by a second transducer 51, represented by the instantaneous speed measuring device 34.

A measurement 52 made by the transducer 51 on the syrup flow rate 45 is fed to the input of the regulating system 46 and subtracted from the water flow rate measurement 47.

The feedback loop is thus closed and the regulating system 46 is able to quickly and effectively compensate for any temporary or continuous differences between the expected water flow rate and that effectively present.

Using the control system 42 it is also very simple for an operator to continuously modify the desired water-syrup dilution ratio.

To achieve this it is necessary only to vary the gain of the closed loop of the feedback regulating system 46 to increase or decrease the syrup flow rate associated with the water flow rate.

With reference to the mechanical scheme of Figure 1, this can be achieved by adjusting the potentiometer 41 connected to the electronic control device 39.

The present invention has been described by way of non-limiting example in that modifications can be made thereto by an expert of the art but without leaving the scope of protection of the present patent.

Claims

1. A drink dispensing machine in which the drink consists of a mixture of syrup and water formed during its withdrawal within a tap (53) of said machine, said syrup originating from a vessel/ container (29) by the action of a pump (31), and said water being fed from a mains

system of substantially variable flow characteristics via a delivery valve (23), characterised in that said machine comprises sensor means (22) for measuring the flow rate of the water fed from said mains system and means for setting a syrup-water dilution ratio, said means being connected to an electronic device (39) for controlling the speed of said syrup feed pump (31) such as to reduce or increase the speed of said pump (31) in accordance with the water flow rate reductions or increases measured by said sensor means (22), to maintain said drink dilution ratio constant.

2. A machine as claimed in claim 1, characterised in that said electronic control device (39) is further connected to a device (36) for measuring the rotation speed of said syrup feed pump (31), said electronic control device (39) being arranged to use measurements made by said rotation speed measuring device (36) to effect feedback regulation of the rotation speed of said syrup feed pump (31).

3. A machine as claimed in claim 1, characterised in that said sensor means for measuring the flow rate of the water fed by said mains system consist of a flow meter (22) comprising a impeller (25), permanent magnets (27) arranged at the ends of each blade of said impeller (25) and a first magnetic Hall effect sensor (26).

4. A machine as claimed in claim 1, characterised in that said device (36) for measuring the rotation speed of said syrup feed pump (31) consists of a perforated disc (35) associated with a photocoupler (36), said disc being rigid with the shaft of the motor (33) for the pump (31).

5. A machine as claimed in claim 1, characterised in that said pump (31) which feeds the syrup from said vessel/container (29) is a peristaltic pump which acts on a flexible discharge tube (30) connected at one end to said vessel/container (29) and at the other end to said tap (53).

6. A machine as claimed in claim 1, characterised in that said electronic control device (39) is connected to a sensor (28) arranged on said delivery valve (23), said sensor (28) being arranged to sense whether said delivery valve (23) is open or closed.

7. A machine as claimed in claim 6, characterised in that on closure of said delivery valve (23), said sensor (28) feeds a stop signal to the motor (33) of said pump (31) via the electronic device (39), to prevent any flow of syrup alone being induced after the closure of said delivery valve (23).

8. A machine as claimed in claim 7, characterised in that said sensor (28) arranged on said delivery valve (23) is a magnetic Hall effect sensor.

9. A machine as claimed in claim 1, characterised in that said means for setting a dilution ratio consist of a potentiometer (41) connected to said electronic control device (39).

10. A machine as claimed in Claim 1, characterised in that said electronic control device (39) effects a continuous closed-loop regulating action.

11. A machine as claimed in Claim 1, characterised in that said continuous closed-loop regulating action effected by said control device (39) is a continuous proportional closed-loop regulating action.

Fig.1

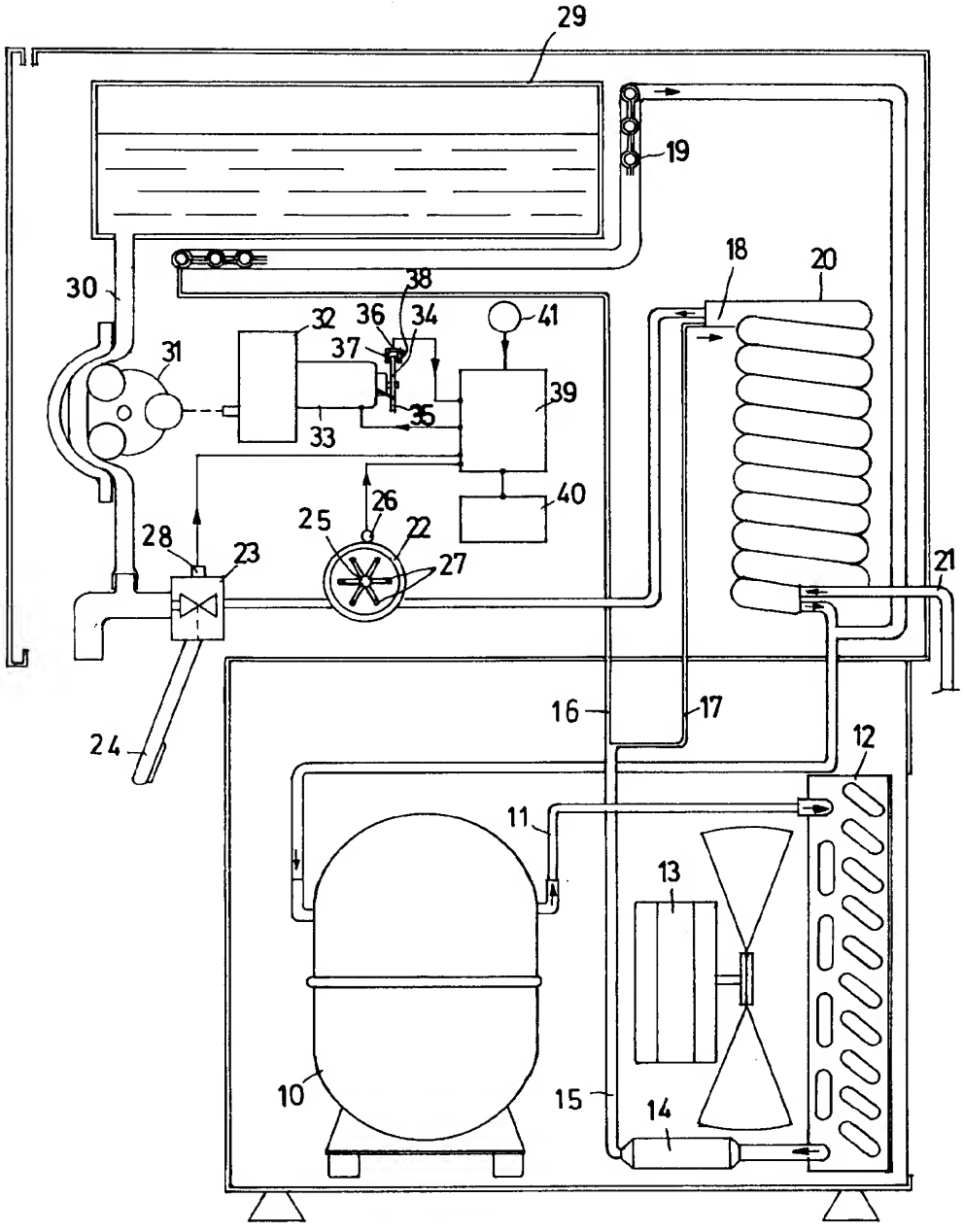
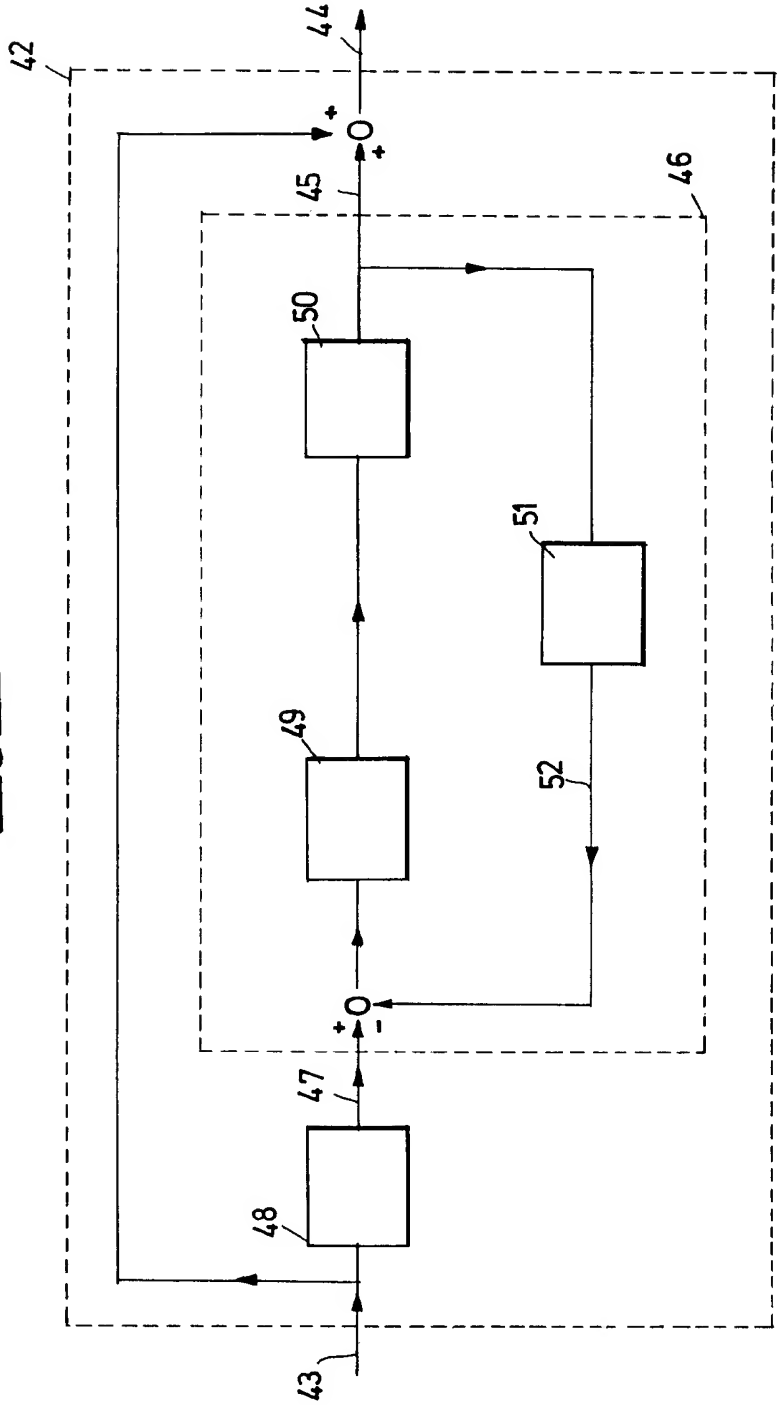

29
19
18
20
30
38
32
36
34
41
31
37
39
35
33
40
26
25
22
28
23
27
21
16
17
24
12
11
13
10
15
14

Fig.2



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 20 1055

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 955 507 (KIRSCHNER ET AL.)	1,2,5,6, 7,10,11	B67D1/00 B67D1/12
Y	* the whole document *	3,4	
Y	GB-A-2 174 459 (JENCONS (SCIENTIFIC) LIMITED) * page 1, line 64 - line 83; figures 1,2 *	3	
Y	GB-A-2 221 209 (LYONAIR LTD.) * page 4, paragraph 2 *	4	
A	EP-A-0 251 793 (PEKTRON LTD.) * abstract *	1,8	
X	US-A-4 189 067 (NOTTKE ET AL.)	1,9	
Y	* abstract * * column 10, line 19 - line 24; figure 9 *	6	
Y	US-A-4 456 149 (SCIORTINO) * column 2, line 57 - line 60 *	6	
X	EP-A-0 387 477 (ROPA WASSERAUFBEREITUNGS-ANLAGENBAU GESELLSCHAFT M.B.H.) * abstract; figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B67D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 JULY 1992	MARTINEZ NAVAR

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)